REMARKS

Claims 1-4, 11-16 and 20-29 are all the claims presently pending in this application. Claims 20-29 have been added to claim additional features of the claimed invention.

It is noted that the amendments are made only to more particularly define the invention and **not** for distinguishing the invention over the prior art, for narrowing the scope of the claims, or for any reason related to a statutory requirement for patentability. It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Claims 1 and 11-13 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Puskorius, U.S. Pat. No. 6,042,548, further in view of Guiffre, U.S. Pat. No. 6,042,548.

Claims 2, 4, 14 and 16 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Puskorius, U.S. Pat. No. 6,042,548 in view of Guiffre, U.S. Pat. No. 6,042,548, further in view of Margolis, U.S. Pat. No. 6,508,102.

Claims 3 and 15 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Puskorius, U.S. Pat. No. 6,042,548 in view of Guiffre, U.S. Pat. No. 6,042,548, further in view of Battiti, "Training Neural Nets with Reactive Tabu Search," and Gangsass, "Application of Modern Synthesis to Aircraft Control: Three Case Studies".

These rejections are respectfully traversed in view of the following discussion.

I. APPLICANT'S CLAIMED INVENTION

The claimed invention (as defined, for example, by independent claim 1) is directed to a vehicle motion model generating device for generating a vehicle motion model that

represents a motion state of a vehicle, including, a first recurrent neural network formed by connecting plural nodes such that an output of a node is input to another node in accordance with a predetermined coupling weight coefficient, including a feedback loop of an output of at least one node, and outputting a vehicle parameter indicating the motion state of the vehicle based on predetermined input information, thereby functioning as the vehicle motion model.

The invention also includes plural second recurrent neural networks, each of the second recurrent neural networks formed by connecting second plural nodes such that a second output of a second node is input to another second node in accordance with a second predetermined coupling weight coefficient, including a second feedback loop of a second output of at least one second node, and outputting a second vehicle parameter different from the vehicle parameter output from the first recurrent neural network and indicating the motion state of the vehicle based on the predetermined input information, thereby functioning as the vehicle motion model.

Furthermore, the invention includes an optimizing unit for determining an optimum solution of the predetermined coupling weight coefficient of the first recurrent neural network and the second predetermined coupling weight coefficient of the plural second recurrent neural networks based on a learning rule using a hereditary algorithm, wherein the first recurrent neural network and the plural second recurrent neural networks are mutually connected to each other such that a state variable including a correlation with the vehicle parameter output from the first recurrent neural network is input to each of the plural second recurrent neural networks.

Conventionally, in the neural network, adjustment (or learning) of the coupling weight coefficient is carried out in advance according to an algorithm such as back propagation so

that the output corresponds to a teaching signal. (Specification at page 3, lines 5-8.)

Additionally, when a vehicle motion model is set, a motion equation is linearly approximated to avoid cumbersome operation processing in the solution calculating process. Therefore, the vehicle motion model may not accurately represent the motion state of the vehicle, that is, the behavior of the vehicle in a non-linear region. (Specification at page 3, lines 10-15.)

Furthermore, in a feed-forward type neural network is used, the value output from the neural network and the value input to the neural network are independent of each other. Thus, the motion state of the vehicle may not be accurately represented in such a neural network. In particular, the values output from the neural network are varied in accordance with not only the input, but also the value thereof at the present time (a present value). Consequently, it is necessary to feed back the output value and reflect the output value to the neural network, in order to estimate the motion state of the vehicle with high precision. However, the neural network having such feedback has a problem that the coupling weight coefficient cannot be learned according to the principle of a learning rule such as back propagation. Thus, accurate estimation of the road surface friction coefficient is hardly achieved. (Specification at page 3, line 16 to page 4, line 11.)

The claimed invention (e.g., as recited in claims 1 and 11-13), on the other hand, includes *plural second recurrent neural networks, each of the second recurrent neural networks formed by connecting second plural nodes such that a second output of a second node is input to another second node in accordance with a second predetermined coupling weight coefficient, including a second feedback loop of a second output of at least one second node.*

These features of Applicant's claimed invention are important is to provide a method of creating a motion model of a vehicle by using a recurrent neural network containing a feedback loop to more accurately estimate the road surface coefficient and vehicle motion parameters, (Specification at page 4, lines 6-21.)

II. THE ALLEGED PRIOR ART REJECTIONS

A. The 35 U.S.C. § 103(a) Rejection over Puskorius, U.S. Pat. No. 6,042,548 further in view of Guiffre, U.S. Pat. No. 6,042,548

The Examiner alleges that Puskorius, U.S. Pat. No. 6,042,548, (Puskorius), further in view of Guiffre, U.S. Pat. No. 6,042,548, (Guiffre), makes obvious the invention of claims 1 and 11-13.

The Examiner alleges that one of ordinary skill in the art would have been motivated to modify Puskorius with the teaching from Guiffre to form the invention of claims 1 and 11-13. Applicant submits, however that these references would not have been combined and even if combined, the combination would not teach or suggest each element of the claimed invention.

The Examiner alleges that Puskorius (in Figure 3 thereof) is equivalent to Applicant's claimed invention by equating nodes 111-115 with Applicant's first RNN, and nodes 116-117 with Applicant's plurality of second RNNs. See diagram below.

Puskorius, U.S. Pat. No. 6,092,018

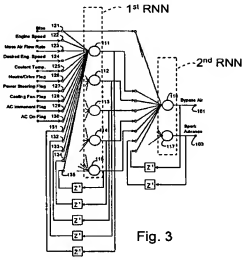


Fig. 3

However, each unit 111-117 of Puskorius does not correspond to a single RNN. Each of them is one node of the single RNN. Specifically, as shown in Puskorius at column 6, lines 53-54, these units 111-115 are the nodes in an intermediate layer (a hidden layer), and the units 116-117 are output nodes. Additionally, Puskorius fails to teach or suggest the concept of emplying a plurality of RNNs. Moreover, this concept is not described as suggested in any of the reference cited by the Examiner. Thus, the argument of Examiner is not reasonable.

Further, Applicant submits that neither Puskorius, nor Guiffre, nor any alleged combination thereof, teaches or suggests, "*a first recurrent neural network formed by connecting plural nodes such that an output of a node is input to another node in accordance with a predetermined coupling weight coefficient, comprising a feedback loop of an output of at least one node, and outputting a vehicle parameter indicating said motion state of the vehicle based on predetermined input information, thereby functioning as said vehicle motion model*," of independent claims 1, 11 and 12.

Puskorius discloses an output of 111-115 at Z^{-1} looping back to the 1st RNN, but there is no disclosure that the output *is input to another node in accordance with a predetermined*

coupling weight coefficient.

Additionally, the Examiner states that Applicant's claimed invention of *a vehicle parameter indicating said motion state of the vehicle* is equivalent to "engine control." Applicant respectfully maintains that a motion state of a vehicle is not equivalent to an "engine control." The engine control parameters of Puskorius of "bypass air" and "spark advance" have nothing to do with a motion state of a vehicle, but merely control the idle speed of an internal combustion engine by controlling the bypass air (throttle duty cycle) and the engine's ignition timing.

Additionally, Puskorius fails to teach nodes 111-115 outputting the engine control parameters of "bypass air" and "spark advance." Fig. 3 clearly shows that nodes 116-117, i.e., the Examiner's alleged 2nd RNN, output the engine control parameters.

Therefore, Puskorius fails to teach or suggest the "bypass air" and "spark advance" parameters "*functioning as said vehicle motion model*," per Applicant's claimed invention.

Additionally, Applicant submits, however, that neither Puskorius, nor Guiffre, nor any alleged combination thereof, teaches or suggests, "*plural second recurrent neural networks, each of said second recurrent neural networks formed by connecting second plural nodes such that a second output of a second node is input to another second node in accordance with a second predetermined coupling weight coefficient, comprising a second feedback loop of a second output of at least one second node, and outputting a second vehicle parameter different from said vehicle parameter output from said first recurrent neural network and indicating said motion state of the vehicle based on said predetermined input information, thereby functioning as said vehicle motion model*," of independent claims 1 and 11, and similarly, "*plural second recurrent neural networks, each of said second recurrent neural*

networks are formed by connecting second plural nodes to another second node in accordance with a second predetermined coupling weight coefficient, comprising a second feedback loop of a second output of at least one second node, and outputting a second vehicle parameter different from said vehicle parameter output from said first recurrent neural network and indicating said motion state of the vehicle based on said predetermined input information, thereby functioning as said vehicle motion model," of independent claim 12.

Puskorius fails to teach or suggest, and the Examiner fails to address Applicant's claimed *plural second recurrent neural networks*. Puskorius only discloses a single 2nd RNN as defined by the Examiner as nodes 116-117, not a plurality of 2nd RNNS.

Puskorius additionally only discloses an output of 116/117 at Z^{-1} looping back to the single 2nd RNN, and there is no disclosure that the output is input to another second node (e.g., 116/117) *in accordance with a second predetermined coupling weight coefficient*.

As noted above, Puskorius fails to teach or suggest that engine control parameters of "bypass air" and "spark advance" parameters have nothing to do with *a motion state of a vehicle*, or *functioning as said vehicle motion model*, per Applicant's claimed invention, but merely control the idle speed of an internal combustion engine by controlling the bypass air (throttle duty cycle) and the engine's ignition timing.

Furthermore, Puskorius fail to teach or suggest the 2nd RNN (116-117) outputting a second parameter (bypass air, spark advance) different from the first parameter of the 1st RNN (111-115).

Additionally, Applicant submits, however, that neither Puskorius, nor Guiffre, nor any alleged combination thereof, teaches or suggests, "*wherein said first recurrent neural network and said plural second recurrent neural networks are mutually connected to each other such*

that a state variable including a correlation with said vehicle parameter output from said first recurrent neural network is input to each of said plural second recurrent neural networks," of independent claims 1, 11 and 12.

As Applicant argues above, Puskorius fails to teach or suggest, and the Examiner fails to address a plurality of 2nd RNNs (e.g., 116-117) *mutually connected to each other*, and *a state variable including a correlation* with the bypass air and spark advance parameter output from 1st RNNs (e.g., 111-115) is input to each of the plurality of 2nd RNNs, since Puskorius, per the Examiner's treatment in the rejection, only discloses a single 2nd RNN.

Applicant submits, however, that neither Puskorius, nor Guiffre, nor any alleged combination thereof, teaches or suggests:

"*determining an optimum solution of a genetic type based on a learning rule using a hereditary algorithm while setting said predetermined coupling weight coefficient of said first recurrent neural network and said second predetermined coupling weight coefficient of said plurality of second recurrent neural networks as said genetic type*," and

"*outputting a state variable from said first recurrent neural network to each of said plural second recurrent neural networks, said state variable including a correlation with said first vehicle parameter*," of independent claim 13.

With respect to Applicant's claimed invention of *a first vehicle parameter... indicating said motion state of the vehicle, at least one second vehicle parameter... indicating said motion state of the vehicle, thereby functioning as said vehicle motion model*, Applicant again maintains, as above, that *a first and second vehicle parameter indicating said motion state of the vehicle* is not equivalent to "engine control." Applicant respectfully traverses the Examiner's argument that a motion state of a vehicle is not equivalent to an engine control.

The engine control parameters of Puskorius of "bypass air" and "spark advance" have nothing to do with a motion state of a vehicle, or a vehicle motion model, but are used to control the idle speed of an internal combustion engine by controlling the bypass air (throttle duty cycle) and the engine's ignition timing.

The Examiner states that Puskorius fails to teach Applicant's claimed invention of *an optimizing unit for determining an optimum solution of said predetermined coupling weight coefficient of said first recurrent neural network and said second predetermined coupling weight coefficient of said plural second recurrent neural networks based on a learning rule using a hereditary algorithm*.

However, Applicant respectfully submits that Puskorius would not have been combined with Guiffre as alleged by the Examiner. Indeed, these references are non-analogous because they are completely unrelated. (Puskorius is directed to an electronic engine control (EEC) module executes a neural network processing program to control the idle speed of an internal combustion engine by controlling the bypass air (throttle duty cycle) and the engine's ignition timing. Guiffre is directed to a monitor that provides registering and/or predicting changes in brain and central nervous system activity by processing cardiovascular monitoring data and using pattern recognition by trained computing means to predict changes in the state of the central nervous system, and problems completely different from those to which the present invention and/or Puskorius are directed.) No person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In fact, Applicant submits that the Examiner can point to no proper motivation or suggestion in the references or of one of ordinary skill in the art to urge the combination as

alleged by the Examiner.

The Examiner allegedly provides motivation for combining Guiffre with Puskorius by citing Guiffre at column 4, lines 38-60. However, this passage fails to provide any relevant disclosure regarding the motivation to combine Guiffre with Puskorius to teach or suggest Applicant's claimed invention. In fact, nowhere in Guiffre is there any disclosure about providing a first and second coupling weight coefficient for use in the first and plurality of second RNNs as claimed in Applicant's invention. Guiffre merely states that a computing system can be trained in real-time at a slower rate to allow for specific human operator data and program manipulation. See entire cited passage reproduced below.

> The self-teaching computer can comprise a neural net software with or without genetic training algorithms (including but not limited to simple multilayer single connection nets, recurrent nets with connections to previous layers with various amounts of dampening in these back connections (Jordan-Elman nets), multiple hidden layers with differing characteristics (Ward nets), recurrent nets where each layer is back-connected to every previous layer (jump connection nets), unsupervised classification net models (Kohonen nets), supervised classification net models (probabilistic nets), nets involving grouped data handling (polynomial and regression nets), and general genetic regression neural networks (GRNN)), a neural net chip with accompanying software and(or) a parallel processor; alone and(or) in combination with standard statistical evaluation means. Such a trained computing means acts in real-time though training can occur at slower rate to allow for specific human operator data and program manipulation, and(or) incorporation of an additional genetic-type algorithm or other optimization system(s) to incrementally perturb the system and(or) change models until data management is optimal. (Emphasis added.) (Guiffre at column 4, lines 38-60.)

Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner.

Guiffre discloses a monitor that provides registering and/or predicting changes in brain and central nervous system activity by processing cardiovascular monitoring data and using pattern recognition by trained computing means to predict changes in the state of the

central nervous system, and the trained computing means acts in real-time though training can occur at slower rate to allow for specific human operator data and program manipulation

The Examiner fails to provide any analysis or specify where Guiffre discloses Applicant's claimed invention, and Guiffre fails to teach or suggest:

"an optimizing unit for determining an optimum solution of said predetermined coupling weight coefficient of said first recurrent neural network and said second predetermined coupling weight coefficient of said plural second recurrent neural networks based on a learning rule using a hereditary algorithm," of claims 1, 11 and 12, and

"setting said predetermined coupling weight coefficient of said first recurrent neural network and said second predetermined coupling weight coefficient of said plurality of second recurrent neural networks as said genetic type," *"outputting an optimum solution of said predetermined coupling weight coefficient to said first recurrent neural network based on said optimum solution of said genetic type,"* *"outputting a second optimum solution of said second predetermined coupling weight coefficient to said plurality of second recurrent neural networks based on said optimum solution of said genetic type,"* and *"outputting a state variable from said first recurrent neural network to each of said plural second recurrent neural networks, said state variable including a correlation with said first vehicle parameter,"* of independent claim 13.

Therefore, Guiffre fails to overcome the deficiencies of Puskorius.

Therefore, Applicant respectfully requests the Examiner to reconsider and withdraw this rejection since the alleged prior art references to Puskorius and Guiffre (either alone or in combination) fail to teach or suggest each element and feature of Applicant's claimed invention.

B. The 35 U.S.C. § 103(a) Rejection over Puskorius, U.S. Pat. No. 6,042,548 in view of Guiffre, U.S. Pat. No. 6,042,548 further in view of Margolis, U.S. Pat. No. 6,508,102

The Examiner alleges that Puskorius, U.S. Pat. No. 6,042,548 in view of Guiffre, U.S. Pat. No. 6,042,548, (Puskorius and Guiffre), further in view of Margolis, U.S. Pat. No. 6,508,102, (Margolis), makes obvious the invention of claims 2, 4, 14 and 16.

The Examiner alleges that one of ordinary skill in the art would have been motivated to modify Puskorius and Guiffre with the teaching from Margolis to form the invention of claims 2, 4, 14 and 16. Applicant submits, however that these references would not have been combined and even if combined, the combination would not teach or suggest each element of the claimed invention.

That is, Margolis fails to make up for the deficiencies of Puskorius and Guiffre as discussed above.

Margolis discloses a friction estimator that provides near-real-time friction estimation while the car is accelerating, braking or turning, wherein the estimate relies on easily measured signals such as yaw rate, lateral acceleration, wheel speed, etc. This estimate can be used to give the driver or a closed-loop controller an advanced warning when the tire force limit is being approached.

The Examiner asserts Margolis discloses a state value representing a road surface conditions and a forward velocity sensor.

However, even assuming *arguendo* that the Examiner's position has some merit, Margolis fails to teach or suggest:

plural second recurrent neural networks, a second output of a second node is input to

another second node in accordance with a second predetermined coupling weight coefficient, outputting a second vehicle parameter different from said vehicle parameter output from said first recurrent neural network and indicating said motion state of the vehicle, thereby functioning as said vehicle motion model, of independent claims 1 and 11, and similarly claim 12; and

said plural second recurrent neural networks are mutually connected to each other such that a state variable including a correlation with said vehicle parameter output from said first recurrent neural network is input to each of said plural second recurrent neural networks, of independent claims 1, 11 and 12.

Therefore, Margolis fails to overcome the deficiencies of Puskorius and Guiffre.

Therefore, Applicant respectfully requests the Examiner to reconsider and withdraw this rejection since the alleged prior art references to Puskorius and Guiffre and Margolis (either alone or in combination) fail to teach or suggest each element and feature of Applicant's claimed invention.

C. The 35 U.S.C. § 103(a) Rejection over Puskorius, U.S. Pat. No. 6,042,548 in view of Guiffre, U.S. Pat. No. 6,042,548 further in view of Battiti ("Training Neural Nets with the Reactive Tabu Search") and Gangsaas ("Application of Modern Synthesis to Aircraft Control: Three Case Studies")

The Examiner alleges that Puskorius, U.S. Pat. No. 6,042,548 in view of Guiffre, U.S. Pat. No. 6,042,548, (Puskorius and Guiffre), further in view of Battiti ("Training Neural Nets with the Reactive Tabu Search") and Gangsaas ("Application of Modern Synthesis to Aircraft Control: Three Case Studies"), makes obvious the invention of claims 3 and 15.

The Examiner alleges that one of ordinary skill in the art would have been motivated

to modify Puskorius and Guiffre with the teachings of Battiti and Gangsaas to form the invention of claims 3 and 15. Applicant submits, however that these references would not have been combined and even if combined, the combination would not teach or suggest each element of the claimed invention.

That is, Battiti and Gangsaas fail to make up for the deficiencies of Puskorius and Guiffre as discussed above.

The Examiner asserts Battiti and Gangsaas discloses a steering angle as a variable (Battiti) and motion parameters of an aircraft of yaw rate, lateral acceleration, roll and pitch (Gangsaas).

However, even assuming *arguendo* that the Examiner's position has some merit, Battiti and Gangsaas fail to teach or suggest:

plural second recurrent neural networks, a second output of a second node is input to another second node in accordance with a second predetermined coupling weight coefficient, outputting a second vehicle parameter different from said vehicle parameter output from said first recurrent neural network and indicating said motion state of the vehicle, thereby functioning as said vehicle motion model, of independent claims 1 and 11, and similarly claim 12; and

said plural second recurrent neural networks are mutually connected to each other such that a state variable including a correlation with said vehicle parameter output from said first recurrent neural network is input to each of said plural second recurrent neural networks, of independent claims 1, 11 and 12.

Therefore, Battiti and Gangsaas fail to overcome the deficiencies of Puskorius and Guiffre.

Therefore, Applicant respectfully requests the Examiner to reconsider and withdraw this rejection since the alleged prior art references to Puskorius and Guiffre and Margolis (either alone or in combination) fail to teach or suggest each element and feature of Applicant's claimed invention.

III. FORMAL MATTERS AND CONCLUSION

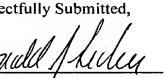
In view of the foregoing, Applicant submits that claims 1-4, 11-16 and 20-29, all of the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: May 30, 2007



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